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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on <u>10 November 2009</u>.
2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.
3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) <u>1,3,10,11,14,17,21 and 25-36</u> is/are pending in the application.
   4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5)☐ Claim(s) _____ is/are allowed.
6)☒ Claim(s) <u>1,3,10,11,14,17,21 and 25-36</u> is/are rejected.
7)☐ Claim(s) _____ is/are objected to.
8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.
10)☒ The drawing(s) filed on <u>9/30/2003</u> is/are: a)☐ accepted or b)☒ objected to by the Examiner.
    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
    a)☐ All b)☐ Some * c)☐ None of:
       1.☐ Certified copies of the priority documents have been received.
       2.☐ Certified copies of the priority documents have been received in Application No. _____.
       3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☒ Notice of References Cited (PTO-892)
2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3)☐ Information Disclosure Statement(s) (PTO/SB/08)
   Paper No(s)/Mail Date _____.

4)☐ Interview Summary (PTO-413)
   Paper No(s)/Mail Date _____.
5)☐ Notice of Informal Patent Application
6)☐ Other: _____.

DETAILED ACTION

This office action is in response to application 10/675,505 and applicant's remarks filed 11/10/2009.

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 11/10/2009 has been entered.

Response to Amendment

In the response filed 11/10/2009, claims 1, 3, 10, 11, 14, 17, and 21 were amended. Claims 25-36 are newly added. Accordingly, claims 1, 3, 10, 11, 14, 17, 21, and 25-36 are pending.

Drawings

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the feature of "detecting a change to a second region of the first volume, wherein the change to the second region is caused by the restore operation, wherein information

identifying the second region cannot be added to the data structure when the change to the second region is detected; and causing the restore operation to fail, in response to the detecting" as found in claim 28 and similar claims 32 and 36 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the

art to which it pertains, or with which it is most nearly connected, to make and use the same and shall
set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 28 and similar claims 32 and 36 are rejected under 35 U.S.C. 112, first

paragraph, as failing to comply with the written description requirement. The claim(s)

contains subject matter which was not described in the specification in such a way as to

reasonably convey to one skilled in the relevant art that the inventor(s), at the time the

application was filed, had possession of the claimed invention.

Specifically, the claims essentially recite the feature of "detecting a change to a

second region of the first volume, wherein the change to the second region is caused by

the restore operation, wherein information identifying the second region cannot be

added to the data structure when the change to the second region is detected; and

causing the restore operation to fail, in response to the detecting".

The specification has been reviewed; however, there appears to be no disclosure

of causing a restore operation to fail when information identifying the second region

cannot be added to the data structure when the change to the second region is

detected.

In particular, the most relevant sections of the written description do not appear

to support the abovementioned limitation:

From [0035], the specification states

*"[0035] When data in a region is changed by an application managing data in the
region, the region can be designated for replication in several ways. For example, a
region can be added to a log (or journal) of changes to regions, where each region
having a change in the log is replicated: This type of designation occurs during normal
application updates to the data in the region. Regions can also be designated for
replication when a change occurs to the region but the region cannot be added to the*

log of changes to regions. Such a situation can occur, for example, when the log of changes to regions becomes full..."

Paragraph [0079] states:

[0079] In one embodiment of the invention, if the primary data are actively being replicated at "Active Replication to Secondary" decision point 510, but changes are not being tracked at "Changes not Replicated Being Tracked" decision point 520, the restore operation fails. The communication link can be made inactive before the primary volume is restored to ensure that a full resynchronization of the secondary volume is enforced.

Therefore, according to the highlighted portions, paragraph 0035 does state wherein information identifying the second region cannot be added and paragraph 0079 does state failure of the restore operation; however, paragraph 0035 does not clearly describe that a restore operation fails from the log of changes being full. Further paragraph 0079, while stating a failure of a restore operation, does not clearly support causing a restore operation to fail in response to detecting a change to a second region of the first volume.

In light of the above, Applicant is respectfully requested to provide further clarification and/or amend the respective claims in support of the specification.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States

only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 3, 10-11, 14, 17, 21, 25, 29, and 33 are rejected under 35 U.S.C. 102(e) as being taught by Earl et al. ('Earl' hereafter, U.S. Patent 2003/020811).

With respect to claim 1, Earl teaches A method comprising:

replicating data from a first volume to a second volume *(0011; e.g. "Whenever data files are updated on a source (primary) server, the software replicates those data files onto a destination (i.e. secondary, target, or backup) server and keeps each server synchronized with the other)*, wherein the replicating comprises copying to the second volume only data from regions *(0011 and 0227; e.g. data files or blocks can be interpreted regions)* of the first volume that are modified by application-driven update operations *(0011; e.g. "Whenever data files are updated on a source...the software replicates those data files" and 0018; e.g. all database files are scanned and all database changes are replicated)*, wherein the application-driven update operations *(0011; e.g. file updates)* are initiated by an application managing data in the first volume *(0227; e.g. Oracle which is well-known as an RDBMS)*;

while the replicating the data from the first volume is being performed *(0052, 0100 and 0193; e.g. Earl describes continuous replication, further, figure 5 shows a replication timeline wherein recovery can be at any time in this period)*, detecting a change to a first region of the first volume *(0048; e.g. Earl describes scanning for database updates and discovering that a database file has been updated)*, wherein the

change is caused by a restore operation *(0032; e.g. Earl describes a restore operation to restore the database to the point in time when a latest snapshot was recorded. Therein it is interpreted that through the restoration operation data is modified to reflect the snapshot)* to restore the first volume *(0011; e.g. source server)* from a third volume *(0041-0043; e.g. the source server is recovered from a snapshot)*, wherein the restore operation is not an application-driven update operation initiated by the application *(0041-0043 wherein the restore operation is initiated by a customer or 0169 wherein Recovery manager 311 performs the recovery)*;

in response to the detecting, adding information identifying the first region to a data structure *(0047 wherein database updates appear in log files)*, wherein the data structure identifies regions of the first volume that are designated for replication *(0052; e.g. first, the data replication process is controlled by a process that continually scans and replicates the database log files...when changes are found on the transaction log files, H.A. ECHOSTREAM Version 2 looks for and replicates changes made to the database data files")*, wherein the adding is performed while the replicating is being performed *(0048; e.g. "...determining how many log files have been updated since data replication began" describes logging during a replication process)*; and

in response to the adding the information to the data structure *(0048; e.g. "when more than two log files have been updated then data replication must occur")*, replicating data modified by the restore operation *(0032; e.g. restore operation)* from the first region of the first volume to the second volume *(0018 wherein all database changes are replicated)*, wherein the replicating the data from the first region is performed while

the replication of the data modified by the application-driven update operations from the first volume is ongoing *(0052, 0100 and 0193; e.g. Earl describes continuous replication; therein changes from both the restore operation and Oracle can be seen as replicated and further 0131 wherein recovery can take place if the replication process is slowed (i.e. "ongoing")*, and wherein the replicating the data from the first volume *(0018)*, the detecting *(0048)*, the adding *(0028)*, and the replicating the data from the first region *(0018)* is performed by a computing device *(0064; e.g. hardware running the software)* implementing a replication facility *(0011; e.g. H.A. ECHOSTREAM which is a disk storage management solution)*.

With respect to claim 3, Earl teaches the method of claim 1 wherein the third volume is a snapshot of the first volume at one point in time (0018).

With respect to claim 10, Earl teaches the method of claim 1 wherein the first volume is accessible by the application during the replicating (0011; e.g. real-time replication whenever data files are updated describes accessing a database during an ongoing replication process).

With respect to claim 11, Earl teaches the method of claim 1 wherein the first volume is accessible by the application while being restored from the third volume (0047; e.g. Oracle performs the recovery to the database).

With respect to claim 14, Earl teaches A system comprising:

a processor (0011);

computer-implemented means for replicating (0018) data from a first volume to a second volume, *(0011; e.g. "Whenever data files are updated on a source (primary) server, the software replicates those data files onto a destination (i.e. secondary, target, or backup) server and keeps each server synchronized with the other),* wherein the replicating comprises copying to the second volume only data from regions *(0011 and 0227; e.g. data files or blocks can be interpreted regions)* of the first volume that are modified by application-driven update operations *(0011; e.g. "Whenever data files are updated on a source...the software replicates those data files" and 0018; e.g. all database files are scanned and all database changes are replicated),* wherein the application-driven update operations *(0011; e.g. file updates)* are initiated by an application managing data in the first volume *(0227; e.g. Oracle which is well-known as an RDBMS);*

computer-implemented means for detecting a change to a first region of the first volume *(0048; e.g. Earl describes scanning for database updates and discovering that a database file has been updated)* while the data is being replicated from the first volume *(0052, 0100 and 0193; e.g. Earl describes continuous replication, further, figure 5 shows a replication timeline wherein recovery can be at any time in this period),* wherein the change is caused by a restore operation *(0032; e.g. Earl describes a restore operation to restore the database to the point in time when a latest snapshot was recorded. Therein it is interpreted that through the restoration operation data is*

modified to reflect the snapshot) to restore the first volume *(0011; e.g. source server)* from a third volume *(0041-0043; e.g. the source server is recovered from a snapshot)*, and wherein the restore operation is not an application-driven update operation initiated by the application *(0041-0043 wherein the restore operation is initiated by a customer or 0169 wherein Recovery manager 311 performs the recovery)*;

computer-implemented means for, in response to detection of the change, adding information identifying the first region to a data structure *(0047 wherein database updates appear in log files)*, wherein the data structure identifies regions of the first volume that are designated for replication *(0052; e.g. first, the data replication process is controlled by a process that continually scans and replicates the database log files...when changes are found on the transaction log files, H.A. ECHOSTREAM Version 2 looks for and replicates changes made to the database data files")*, and wherein the information is added while the data is being replicated from the first volume *(0048; e.g. "...determining how many log files have been updated since data replication began" describes logging during a replication process)*; and

computer-implemented means for, in response to the addition of the information *(0048; e.g. "when more than two log files have been updated then data replication must occur")*, replicating data modified by the restore operation *(0032; e.g. restore operation)* from the first region of the first volume to the second volume *(0018 wherein all database changes are replicated)* wherein the data from the first region is replicated while the data modified by the application-driven update operations is being replicated from the first volume *(0052, 0100 and 0193; e.g. Earl describes continuous replication; therein*

changes from both the restore operation and Oracle can be seen as replicated and further 0131 wherein recovery can take place if the replication process is slowed (i.e. "ongoing").

With respect to claim 17, Earl teaches A system comprising:

a processor; and a memory coupled to the processor, wherein the memory stores program instructions executable by the processor to implement a replication facility (0011), and wherein the replication facility is configured to:

replicate data from a first volume to a second volume *(0011; e.g. "Whenever data files are updated on a source (primary) server, the software replicates those data files onto a destination (i.e. secondary, target, or backup) server and keeps each server synchronized with the other)* by copying to the second volume only data from regions *(0011 and 0227; e.g. data files or blocks can be interpreted regions)* of the first volume that are modified by application-driven update operations *(0011; e.g. "Whenever data files are updated on a source...the software replicates those data files" and 0018; e.g. all database files are scanned and all database changes are replicated),* wherein the application-driven update operations *(0011; e.g. file updates)* are initiated by an application managing data in the first volume *(0227; e.g. Oracle which is well-known as an RDBMS);*

while data from the first volume is being replicated *(0052, 0100 and 0193; e.g. Earl describes continuous replication, further, figure 5 shows a replication timeline wherein recovery can be at any time in this period),* detect a change to a first region of

the first volume *(0048; e.g. Earl describes scanning for database updates and discovering that a database file has been updated)*, wherein the change is caused by a restore operation *(0032; e.g. Earl describes a restore operation to restore the database to the point in time when a latest snapshot was recorded. Therein it is interpreted that through the restoration operation data is modified to reflect the snapshot)* to restore the first volume *(0011; e.g. source server)* from a third volume *(0041-0043; e.g. the source server is recovered from a snapshot)*, and wherein the restore operation is not an application-driven update operation initiated by the application *(0041-0043 wherein the restore operation is initiated by a customer or 0169 wherein Recovery manager 311 performs the recovery)*;

in response to detection of the change, add information identifying the first region to a data structure *(0047 wherein database updates appear in log files)*, wherein the data structure identifies regions of the first volume that are designated for replication *(0052; e.g. first, the data replication process is controlled by a process that continually scans and replicates the database log files...when changes are found on the transaction log files, H.A. ECHOSTREAM Version 2 looks for and replicates changes made to the database data files")*, and wherein the information is added while the data from the first volume is being replicated *(0048; e.g. "...determining how many log files have been updated since data replication began" describes logging during a replication process)*; and

in response to the addition of the information *(0048; e.g. "when more than two log files have been updated then data replication must occur")*, replicate data modified

by the restore operation *(0032; e.g. restore operation)* from the first region of the first

volume to the second volume *(0018 wherein all database changes are replicated)*,

wherein the data modified by the application-drive update operations from the first

region is replicated while the data is being replicated from the first volume *(0052, 0100*

and 0193; e.g. Earl describes continuous replication; therein changes from both the

restore operation and Oracle can be seen as replicated and further 0131 wherein

recovery can take place if the replication process is slowed (i.e. "ongoing").

With respect to claim 21, Earl teaches A computer-readable storage medium

comprising program instructions executable to:

replicate data from a first volume to a second volume *(0011; e.g. "Whenever data*

files are updated on a source (primary) server, the software replicates those data files

onto a destination (i.e. secondary, target, or backup) server and keeps each server

synchronized with the other) by copying to the second volume only data from regions

(0011 and 0227; e.g. data files or blocks can be interpreted regions) of the first volume

that are modified by application-driven update operations *(0011; e.g. "Whenever data*

files are updated on a source…the software replicates those data files" and 0018; e.g.

all database files are scanned and all database changes are replicated), wherein the

application-driven update operations *(0011; e.g. file updates)* are initiated by an

application managing data in the first volume *(0227; e.g. Oracle which is well-known as*

an RDBMS);

while data from the first volume is being replicated *(0052, 0100 and 0193; e.g. Earl describes continuous replication, further, figure 5 shows a replication timeline wherein recovery can be at any time in this period)*, detect a change to a first region of the first volume *(0048; e.g. Earl describes scanning for database updates and discovering that a database file has been updated)*, wherein the change is caused by a restore operation *(0032; e.g. Earl describes a restore operation to restore the database to the point in time when a latest snapshot was recorded. Therein it is interpreted that through the restoration operation data is modified to reflect the snapshot)* to restore the first volume *(0011; e.g. source server)* from a third volume *(0041-0043; e.g. the source server is recovered from a snapshot)*, and wherein the restore operation is not an application-driven update operation initiated by the application *(0041-0043 wherein the restore operation is initiated by a customer or 0169 wherein Recovery manager 311 performs the recovery)*;

in response to detection of the change, add information identifying the first region to a data structure *(0047 wherein database updates appear in log files)*, wherein the data structure identifies regions of the first volume that are designated for replication *(0052; e.g. first, the data replication process is controlled by a process that continually scans and replicates the database log files...when changes are found on the transaction log files, H.A. ECHOSTREAM Version 2 looks for and replicates changes made to the database data files")*, and wherein the information is added while the data from the first volume is being replicated *(0048; e.g. "...determining how many log files have been*

updated since data replication began" describes logging during a replication process);
and

in response to the addition of the information *(0048; e.g. "when more than two log files have been updated then data replication must occur")*, replicate data modified by the restore operation *(0032; e.g. restore operation)* from the first region of the first volume to the second volume *(0018 wherein all database changes are replicated)*, wherein the data modified by the application-drive update operations from the first region is replicated while the data is being replicated from the first volume *(0052, 0100 and 0193; e.g. Earl describes continuous replication; therein changes from both the restore operation and Oracle can be seen as replicated and further 0131 wherein recovery can take place if the replication process is slowed (i.e. "ongoing")*.

With respect to claim 25, Earl teaches the method of claim 1, wherein the data structure comprises a log (0019; e.g. LOG file).

With respect to claim 29 Earl teaches the system of claim 17, wherein the data structure comprises a log (0019; e.g. LOG file).

With respect to claim 33, Earl teaches the computer readable storage medium of claim 21, wherein the data structure comprises a log (0019; e.g. LOG file).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 26-27, 30-31, and 34-35 are rejected under 35 U.S.C. 103(a) as being

unpatentable over Earl as applied respectively to claims 1, 17, and 21 above in

view of Tamer et al. ('Tamer' hereafter, U.S. Patent 6,035,412.

With respect to claim 26, Earl does not expressly teach the method of claim 1,

wherein the data structure comprises a replication bitmap, and wherein the adding

comprises performing a logical OR operation to combine the replication bitmap with a

restoration bitmap identifying regions affected by the restore operation.

Tamer, however, teaches wherein the data structure comprises a replication

bitmap *(col. 7 lines 60-64 and col. 8 lines 38-33)*, and wherein the adding comprises

performing a logical OR operation to combine *(col. 10 line 19-20)* the replication bitmap

with a restoration bitmap (col. 12 lines 11-13 and) identifying regions affected by the

restore operation *(col. 12 lines 25-27)* for identifying modified data.

In the same field of endeavor, (i.e. data replication and restoration), it would have

been obvious to one of ordinary skill in the data processing art at the time of the present

invention to combine the teachings of the cited references because the teachings of

Tamer would have given Earl a simpler method of tracking changes for the benefit of

replication speed and efficiency. Earl disposes such a need when they use numbers to indicate changed blocks (e.g. 0147) and further when they scan the database log (e.g. 0052-0053).

With respect to claim 27, Earl does not appear to teach the method of claim 1, wherein the adding comprises combining the data structure and an additional data structure, wherein the additional data structure identifies regions of the first volume that are not synchronized with a snapshot of the first volume.

Tamer, however, teaches wherein the adding comprises combining *(col. 10 line 19-20)* the data structure *(col. 10 line 19; e.g. a bit map)* and an additional data structure *(col. 10 line 65-66; e.g. a bitmap for a mirror)*, wherein the additional data structure identifies regions of the first volume that are not synchronized with a snapshot of the first volume *(col. 10 lines 50-66)* for identifying modified data.

In the same field of endeavor, (i.e. data replication and restoration), it would have been obvious to one of ordinary skill in the data processing art at the time of the present invention to combine the teachings of the cited references because the teachings of Tamer would have given Earl a simpler method of tracking changes for the benefit of replication speed and efficiency. Earl disposes such a need when they use numbers to indicate changed blocks (e.g. 0147) and further when they scan the database log (e.g. 0052-0053).

With respect to claim 30, Earl does not expressly teach the system of claim 17, wherein the data structure comprises a replication bitmap, and wherein the information is added to the data structure by performing a logical OR operation to combine the replication bitmap with a restoration bitmap identifying regions affected by the restore operation.

Tamer, however, teaches wherein the data structure comprises a replication bitmap *(col. 7 lines 60-64 and col. 8 lines 38-33)*, and wherein the adding comprises performing a logical OR operation to combine *(col. 10 line 19-20)* the replication bitmap with a restoration bitmap (col. 12 lines 11-13 and) identifying regions affected by the restore operation *(col. 12 lines 25-27)* for identifying modified data.

In the same field of endeavor, (i.e. data replication and restoration), it would have been obvious to one of ordinary skill in the data processing art at the time of the present invention to combine the teachings of the cited references because the teachings of Tamer would have given Earl a simpler method of tracking changes for the benefit of replication speed and efficiency. Earl disposes such a need when they use numbers to indicate changed blocks (e.g. 0147) and further when they scan the database log (e.g. 0052-0053).

With respect to claim 31, Earl does not expressly teach the system of claim 17, wherein the information is added to the data structure by combining the data structure and an additional data structure, wherein the additional data structure identifies regions of the first volume that are not synchronized with a snapshot of the first volume.

Tamer, however, teaches wherein the information is added to the data structure by combining *(col. 10 line 19-20)* the data structure *(col. 10 line 19; e.g. a bit map)* and an additional data structure *(col. 10 line 65-66; e.g. a bitmap for a mirror)*, wherein the additional data structure identifies regions of the first volume that are not synchronized with a snapshot of the first volume *(col. 10 lines 50-66)* for identifying modified data.

In the same field of endeavor, (i.e. data replication and restoration), it would have been obvious to one of ordinary skill in the data processing art at the time of the present invention to combine the teachings of the cited references because the teachings of Tamer would have given Earl a simpler method of tracking changes for the benefit of replication speed and efficiency. Earl disposes such a need when they use numbers to indicate changed blocks (e.g. 0147) and further when they scan the database log (e.g. 0052-0053).

With respect to claim 34, Earl does not appear to teach the computer readable storage medium of claim 21, wherein the data structure comprises a replication bitmap, and wherein the information is added to the data structure by performing a logical OR operation to combine the replication bitmap with a restoration bitmap identifying regions affected by the restore operation.

Tamer, however, teaches wherein the data structure comprises a replication bitmap *(col. 7 lines 60-64 and col. 8 lines 38-33)*, and wherein the adding comprises performing a logical OR operation to combine *(col. 10 line 19-20)* the replication bitmap

with a restoration bitmap (col. 12 lines 11-13 and) identifying regions affected by the

restore operation *(col. 12 lines 25-27)* for identifying modified data.

In the same field of endeavor, (i.e. data replication and restoration), it would have

been obvious to one of ordinary skill in the data processing art at the time of the present

invention to combine the teachings of the cited references because the teachings of

Tamer would have given Earl a simpler method of tracking changes for the benefit of

replication speed and efficiency. Earl disposes such a need when they use numbers to

indicate changed blocks (e.g. 0147) and further when they scan the database log (e.g.

0052-0053).

With respect to claim 35, Earl does not expressly teach the computer readable

storage medium of claim 21, wherein the information is added to the data structure by

combining the data structure and an additional data structure, wherein the additional

data structure identifies regions of the first volume that are not synchronized with a

snapshot of the first volume.

Tamer, however, teaches wherein the information is added to the data structure

by combining *(col. 10 line 19-20)* the data structure *(col. 10 line 19; e.g. a bit map)* and

an additional data structure *(col. 10 line 65-66; e.g. a bitmap for a mirror)*, wherein the

additional data structure identifies regions of the first volume that are not synchronized

with a snapshot of the first volume *(col. 10 lines 50-66)* for identifying modified data.

In the same field of endeavor, (i.e. data replication and restoration), it would have

been obvious to one of ordinary skill in the data processing art at the time of the present

invention to combine the teachings of the cited references because the teachings of

Tamer would have given Earl a simpler method of tracking changes for the benefit of

replication speed and efficiency. Earl disposes such a need when they use numbers to

indicate changed blocks (e.g. 0147) and further when they scan the database log (e.g.

0052-0053).

**Claims 28, 32, and 36 are rejected under 35 U.S.C. 103(a) as being
unpatentable over Earl as applied respectively to claims 1, 17, and 21 above in
view of Tal et al. ('Tal' hereafter, U.S. Patent 7,107,589).**

With respect to claim 28, Earl teaches, the method of claim 1, further comprising:

detecting a change to a second region of the first volume *(0047; e.g. when two
log files have been updated)*, wherein the change to the second region is caused by the

restore operation *(0032)*, wherein information identifying the second region cannot be

added to the data structure when the change to the second region is detected *(0053;
e.g. when the database log file fills up and therefore it is interpreted that no more
information can be added)*.

Earl does not appear to expressly describe causing the restore operation to fail,

in response to the detecting.

Tal, however, teaches causing the restore operation to fail, in response to the

detecting *(col. 10 lines 21-26)* for halting a migration *(e.g. migration being analogous to
a restore operation in that data transfer fails)*.

In the same field of endeavor, (i.e. logging and data transfer), it would have been obvious to one of ordinary skill in the data processing art at the time of the present invention to combine the teachings of the cited references because Tal would have given Earl an indication of failure (e.g. in 0053 and 0245), Earl contemplates the option of failure during logging) for the benefit of ensuring pending transactions are not lost (a need disclosed by Earl, 0053).

With respect to claim 32, Earl teaches the system of claim 17, wherein the replication facility is configured to:

detect a change to a second region of the first volume *(0047; e.g. when two log files have been updated)*, wherein the change to the second region is caused by the restore operation *(0032)*, wherein information identifying the second region cannot be added to the data structure when the change to the second region is detected *(0053; e.g. when the database log file fills up and therefore it is interpreted that no more information can be added)*.

Earl does not appear to expressly describe causing the restore operation to fail, in response to detecting the change to the second region at a time at which the information identifying the second region cannot be added to the data structure.

Tal, however, teaches causing the restore operation to fail, in response to detecting the change to the second region at a time at which the information identifying the second region cannot be added to the data structure *(col. 10 lines 21-26)* for halting

a migration *(e.g. migration being analogous to a restore operation in that data transfer fails)*.

In the same field of endeavor, (i.e. logging and data transfer), it would have been obvious to one of ordinary skill in the data processing art at the time of the present invention to combine the teachings of the cited references because Tal would have given Earl an indication of failure (e.g. in 0053 and 0245), Earl contemplates the option of failure during logging) for the benefit of ensuring pending transactions are not lost (a need disclosed by Earl, 0053).

With respect to claim 36, Earl does not expressly teach the computer readable storage medium of claim 21, wherein the program instructions are executable to:

detect a change to a second region of the first volume, wherein the change to the second region is caused by the restore operation, wherein information identifying the second region cannot be added to the data structure when the change to the second region is detected; cause the restore operation to fail, in response to detecting the change to the second region at a time at which the information identifying the second region cannot be added to the data structure.

Tal, however, teaches causing the restore operation to fail, in response to detecting the change to the second region at a time at which the information identifying the second region cannot be added to the data structure *(col. 10 lines 21-26)* for halting a migration *(e.g. migration being analogous to a restore operation in that data transfer fails)*.

In the same field of endeavor, (i.e. logging and data transfer), it would have been obvious to one of ordinary skill in the data processing art at the time of the present invention to combine the teachings of the cited references because Tal would have given Earl an indication of failure (e.g. in 0053 and 0245), Earl contemplates the option of failure during logging) for the benefit of ensuring pending transactions are not lost (a need disclosed by Earl, 0053).

Response to Arguments

Applicant's arguments with respect to the claims have been considered but are moot in view of the new ground(s) of rejection.

In furtherance, the applied prior art of Huras and Shih in the previous Office Action do not appear to expressly teach alone or in combination performing both a normal replication, which replicates only changes caused by application-driven update operations, and replication of changes caused by non-application-driven operations such as the restore application of claim 1 as remarked by applicant on page 2, of the reply submitted 10/14/2009. Accordingly these references have been withdrawn in light of the amendments; however, Earl as applied above is submitted to teach the claims as recited. Therefore, in view of the new ground of rejection, the arguments are moot.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. Patent 6,728,898 issued to Tremblay et al. The subject matter disclosed therein pertains to the pending claims (i.e. recovery bit map).

U.S. Patent 6,662,197 issued to LeCrone et al. The subject matter disclosed therein pertains to the pending claims (i.e. combining bitmaps).

U.S. Patent 7,567,991 issued to Armangau et al. The subject matter disclosed therein pertains to the pending claims (i.e. replication and recovery).

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ROBERT TIMBLIN whose telephone number is (571)272-5627. The examiner can normally be reached on M-Th 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John R. Cottingham can be reached on 571-272-7079. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/ROBERT TIMBLIN/
Examiner, Art Unit 2167